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I, LEANNE MYNOTT, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Complete specification in connection with Application No. 47412/99 for a patent by AUSTRALIAN SHIPPING LOGISTICS PTY LTD filed on 07 September 1999.

WITNESS my hand this
Eleventh day of May 2000

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Fumigation Apparatus

Field of the Invention

The present invention relates to a fumigation apparatus. The invention will primarily be described with reference to its use to provide fumigation of timber dunnage and other waste shipping cargo packaging material, but it should be realised that the invention can have broader applications to any other bulk materials, goods or produce which may contain pests or insects or other vermin and which therefore require fumigation.

Background Art

Large quantities of timber and packing materials are carried all over the world in container ships and such goods remain largely useless at the point of arrival of the ship due to the likelihood of it containing pests, parasites, insects or other vermin from another country, such as for example borers, lice, ticks, fleas or termites. It is best that the timber dunnage and other bulk materials do not have to leave the confines of the wharf or port vicinity to travel to a distant site for effective treatment, since this would pose an environmental exposure risk.

Fumigation devices for bulk materials are known in the art that involve placement of a heavy, impervious blanket or other covering article over the materials followed by subsequent addition of toxic gas flow under the blanket to fumigate the covered goods. Current methods of fumigation under blankets are crude, ineffective at fully eliminating insect infestation since no mixing of gases with dunnage can occur, and highly dangerous from an occupational health standpoint since the gases used for effective fumigation are extremely toxic.

Summary of the Invention

The present invention in a first aspect provides fumigation apparatus including a conventional shipping

container, a partition dividing the container into a fumigation chamber and a control room, means arranged to supply gas into the fumigation chamber, control means located in the control room arranged to control the flow of gas into the fumigation chamber and extraction means arranged to remove gas from the fumigation chamber as controlled from the control room.

Such an arrangement allows the fumigation apparatus to be constructed within a conventional shipping container. Such a container is in all respects suitable for handling and use in the wharf or port vicinity. In fact, if available, effective fumigation of dunnage on site at the wharf by skilled operators would allow for the safe treatment and removal of this material for re-use as firewood or for building purposes, would eliminate the possibility of insects or vermin escaping into the environment, would speed up the fumigation processing rate and would provide some enhanced health and safety benefits.

Preferably the partition is secure against the passage of gases. This means that toxic gases from the process in the fumigation chamber will not pose any occupational health risk to operators of the fumigation apparatus during processing, while they may be standing in the control room. It also provides an all weather secure location for associated control equipment.

Preferably the control room incorporates a source of liquified fumigation reagent which is preferably directly associated with a heating source, the latter used to convert the liquified fumigation reagent into gaseous form. The heat energy transferred to the fumigation reagent should be such that the reagent becomes more buoyant than the ambient air. Preferably the fumigation apparatus has a source of liquified fumigation reagent and a heating source which are contained in an appropriate storage box which is secure against the passage of gases.

Preferably the control room incorporates a system control box and a system of gas delivery pipes and valves adapted in use to supply gas from the supply source in the control room to the fumigation chamber.

Preferably the fumigation chamber has openable end doors at the distal end of the fumigation chamber from the partition, the end doors when closed being secure against the passage of gases and further being fitted with external locking cam devices adapted to be secured with a latch and pin arrangement. It is most preferred that the fumigation apparatus has means provided for facilitation of the loading and removal of quantities of material for fumigation by use of a moveable floor adapted to enter or exit the fumigation chamber by means of the end doors.

Preferably the fumigation apparatus has means provided for the supply of gas from the supply source in the control room into the fumigation chamber using a dispersion pipe system located in the upper part of the fumigation chamber. Such an arrangement allows the toxic gases, which by nature are heavier than air, to fall in a dispersed fashion downward over the top of the timber and dunnage charge which has been loaded into the fumigation chamber.

Preferably the fumigation apparatus contains a fumigation chamber provided with a plurality of gas mixing fans adapted to circulate gases within the chamber. Such an arrangement allows more even and thorough dispersion of the toxic gases as they enter and are dispersed in the fumigation chamber.

Preferably the fumigation apparatus contains means for evacuation of the fumigation chamber gases using a pipe attached to an orifice located in a lower region of the partition wall, the pipe being connected in turn to an actuated butterfly valve further connected in turn to a contra-rotating fan adapted to provide suction for the extraction of the gases. Most preferably the fumigation apparatus has the contra-rotating fan connected to deliver

gases by means of a pipe to an exhaust stack positioned vertically above the fumigation container, the uppermost terminal of the exhaust stack being fitted with a gas diffuser and appropriate rain guard.

Preferably the fumigation apparatus has a fumigation chamber containing a plurality of small diameter floor and wall-mounted pipes independently connected via an appropriate system of taps and connectors to a gas sampling and detection meter unit located in the control room. More preferably the floor and wall-mounted pipes may be further adapted to be are located in recessed grooves or which may form part of the construction of the walls or floor.

Preferably the fumigation apparatus has a control room with a system control box which contains the gas detection meter unit and power supply switches for mixing fans, exhaust fan, lights, gas heaters and valve actuators.

Brief Description of the Drawings

Notwithstanding any other forms which may fall within its scope, one preferred form of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a perspective schematic view of a shipping container in phantom fitted internally in accordance with the invention with a fumigation chamber and a control room, and

Figure 2 is a similar view to Figure 1 showing the flow direction of gas between process units.

Modes for Carrying out the Invention

Referring to the drawings, fumigation apparatus included in a conventional shipping container 10 includes a partition 14 dividing the container into a control room 12 and a fumigation chamber 16. The control room 12 contains a heating source 18 and a source of liquified fumigation reagent 20 both items contained in a storage box 22 secure against the passage of gases. The control room also has a vented door 23 to provide external access. Piping means 24

exist for the supply and distribution of heated toxic gases directly to the fumigation chamber 16. Such an arrangement ensures firstly that the heavy toxic gas molecules, for example methyl bromide, are appropriately gasified and dispersed in air for transfer into the fumigation chamber. The gas-tight storage box 22 ensures that the toxic gases being fed to the fumigation process will not pose any occupational health risk to operators of the fumigation apparatus while those operators may be standing in the control room 12 during that period when the gas undergoes heating during processing.

The control room 12 contains a system control box 26 which functions to control the flow of toxic gas into the fumigation chamber 16. Such an arrangement ensures that at all times the availability of fumigation gases is able to be manually controlled which ensures that highly safe operating procedures can be maintained.

A nominal number of mixing fans, in this case two fans 28 and 30, circulate gases within the fumigation chamber 16 when operating. Mixing fans located by appropriate wall-mountings on the partition 14 dividing the container into a fumigation chamber 16 and a control room 12 would provide sufficient circulation to prevent the toxic gases, which are heavier than air, from only locating in the lower portion of the fumigation chamber.

Gas-tight end doors 32 provide access to the fumigation chamber 16 when it is not operating. Moveable floor 34 is constructed to slide in and out of gas-tight end doors 32. Such an arrangement means that bulk quantities of large individual or odd-shaped pieces of timber and dunnage may be conveniently loaded into the fumigation chamber 16 because of the size of the entrance doors and the access provided by the moveable tray floor. Conventional shipping containers have gas-tight end doors 32 which makes them very suitable pieces of equipment in this regard.

Means for evacuation of the fumigation chamber gases include a pipe 36 attached to an orifice 38 located in the lower region of the partition 14, the pipe 36 in turn connected to an actuated butterfly valve 40 and a contra-rotating fan 42 and thence to a pipe exhaust stack 44, the uppermost terminal of which is fitted with a gas diffuser and appropriate rain guard 46. Control of the actuated butterfly valve 40 and contra-rotating fan 42 are by means of system control box 26. Such an arrangement allows the toxic, heavier than air gases to be removed by fan induced suction from the fumigation chamber 16 at an appropriate lower height, where said gas molecules will naturally congregate without recirculation, followed by dispersion to the external atmosphere via a stack 44 which is of sufficient height to allow the gas contents of the fumigation chamber to be safely vented without occupational health risk exposure to operators or others located nearby the fumigation apparatus.

A plurality of gas sampling lines 48 are mounted on both the walls and floor of fumigation chamber 16 and connected via an appropriate system of pipes and connectors to a gas flow meter test unit located within system control box 26. Such an arrangement provides a gas sampling system which is connected in use to a gas flow meter test unit which draws small amounts of the gaseous contents of the fumigation chamber 16 and delivers a reading as to the concentration of toxic gas remaining in the fumigation chamber 16 during the venting procedure. This monitoring is carried out to ensure that the main fumigation chamber doors 32 may be safely opened for the purposes of removing the charged timber and dunnage material without occupational health risk exposure to operators or others located nearby the fumigation apparatus.

System control box 26 also includes power supply switches and circuits for operating heating source 18, mixing fans 28 and 30 and, as stated earlier, actuated

butterfly valve 40 and contra-rotating fan 42. Interior lights 50 would also be controlled from the system control box 26. Such an arrangement provides a central and securable location for all electrically operated devices, which is important when sequential operational steps are required.

During use, dunnage and timber material for fumigation is loaded onto moveable floor 34 and then inserted into fumigation chamber 16 using gas-tight end doors 32 to provide access for the load. The end doors 32 are then sealed and heated toxic gases, generated by warming liquified fumigation reagent 20 by means of heating source 18, directly enter the fumigation chamber 16 via piping means 24. System control box 26 functions to control the flow of toxic gas into the fumigation chamber. As illustrated in Figure 1, two mixing fans 28 and 30 circulate gases within the fumigation chamber 16 when in use to provide good mixing of toxic gases with the charged material. When the fumigation interval is complete, the recirculation fans 28 and 30 are switched off, the flow of toxic gas into the chamber is stopped and gas is evacuated from fumigation chamber 16, flowing consecutively through orifice 38, pipe 36, actuated butterfly valve 40 and contra-rotating fan 42 before exiting the apparatus via pipe exhaust stack 44. As a safety check of the concentration of toxic gases remaining in the fumigation chamber 16, gas samples are drawn via a plurality of gas sampling lines 48 to a gas flow meter test unit located within system control box 26 and a readout is obtained so that the operator may ascertain when it is safe to reopen end doors 32 and remove the dunnage and timber material from moveable floor 34 after fumigation. At this point the apparatus is ready for a new load of material for fumigation and a repeat procedure.

Claims

1. Fumigation apparatus including a conventional shipping container, a partition dividing the container into a fumigation chamber and a control room, means arranged to supply gas into the fumigation chamber, control means located in the control room arranged to control the flow of gas into the fumigation chamber and extraction means arranged to remove gas from the fumigation chamber as controlled from the control room.

2. Fumigation apparatus as claimed in claim 1 wherein the partition dividing the container into a fumigation chamber and a control room is secure against the passage of gases.

3. Fumigation apparatus as claimed in claim 2 wherein the control room incorporates a source of liquified fumigation reagent.

4. Fumigation apparatus as claimed in claim 3 wherein the source of liquified fumigation reagent is associated with a heating source to convert the liquified fumigation reagent into gaseous form at a temperature such that the reagent is more buoyant than the ambient air.

Dated this 7th day of September 1999

KENNETH GEORGE BRASH

by his Patent Attorneys

GRIFFITH HACK

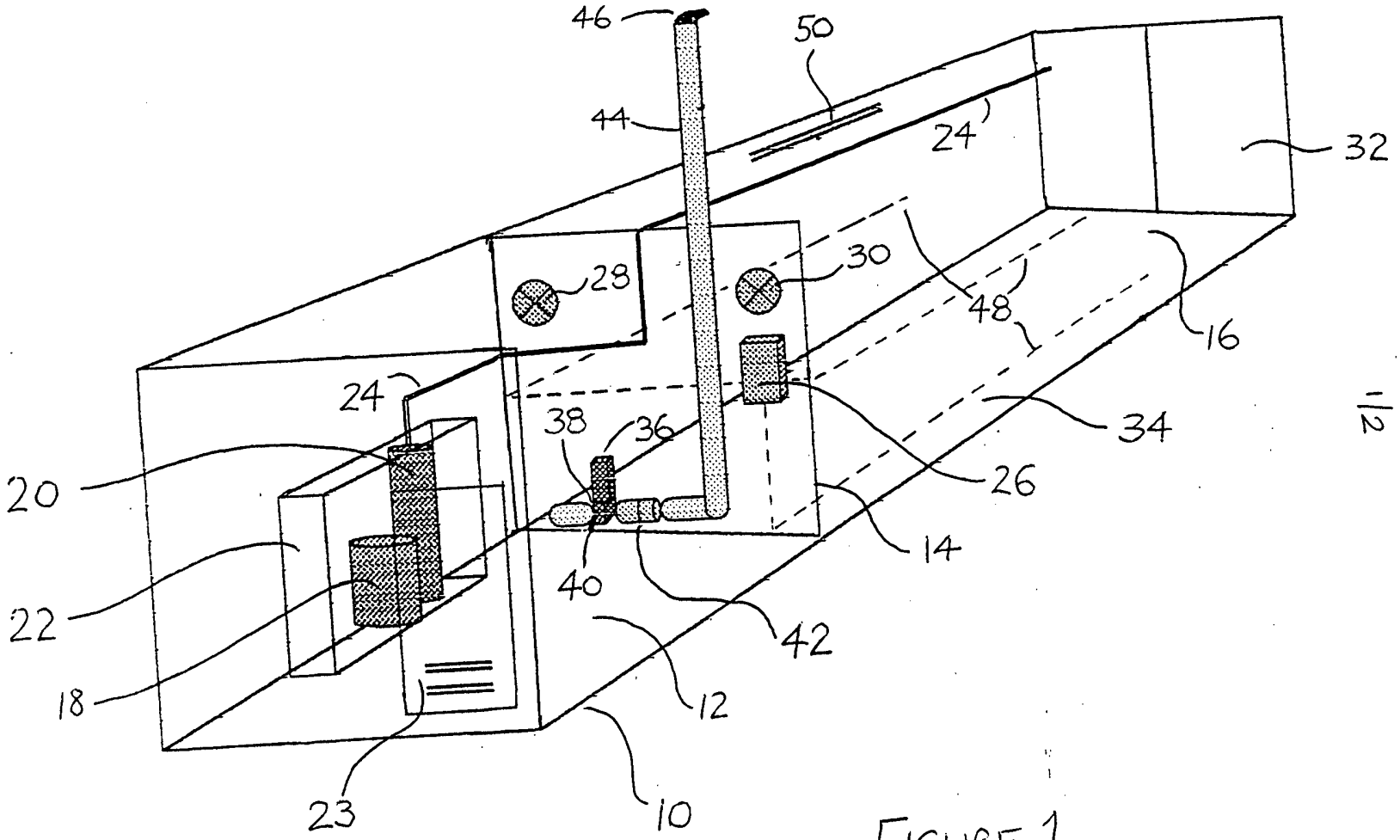


FIGURE 1

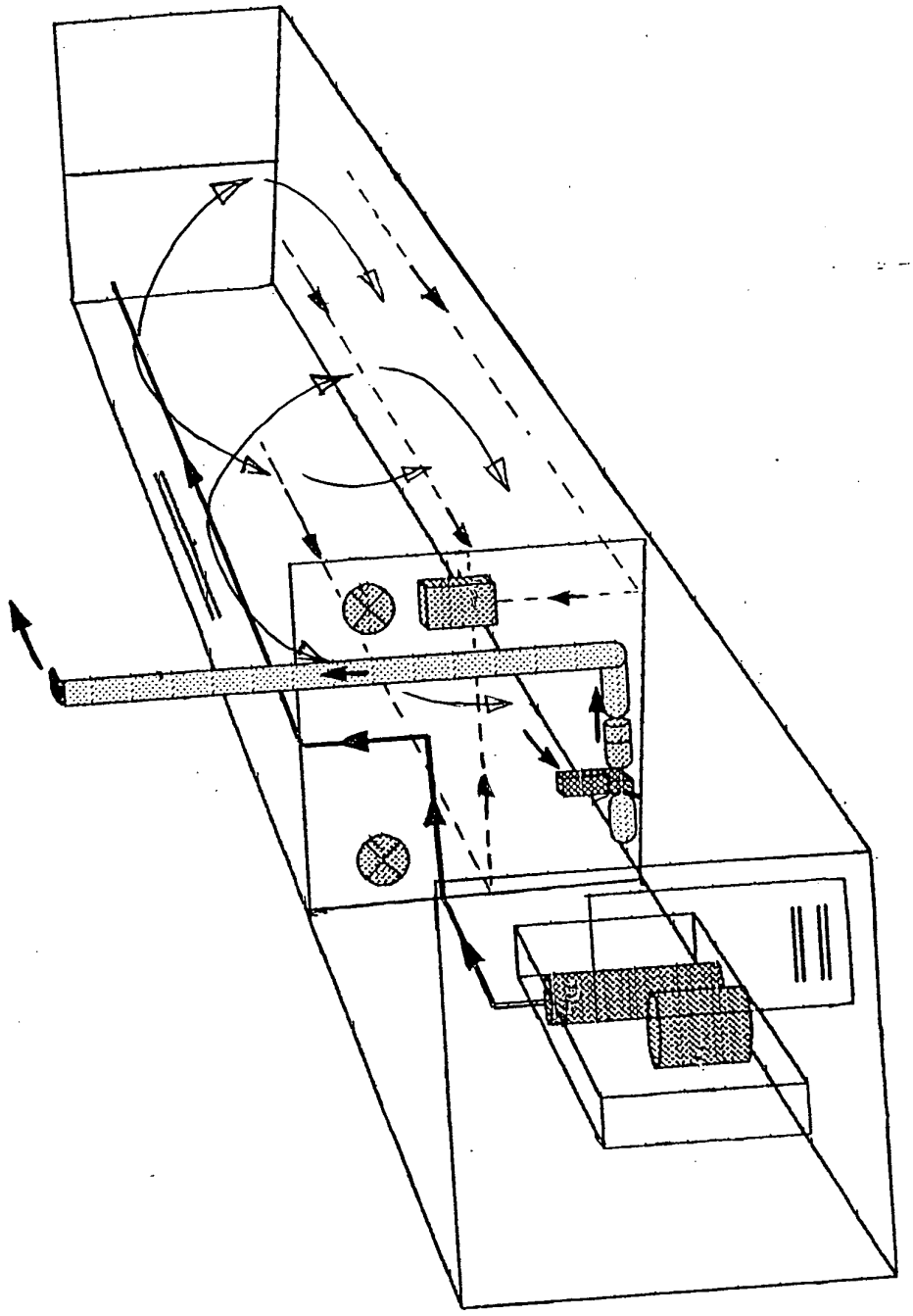


FIGURE 2

ABSTRACT

As can be seen in Figure 1, fumigation apparatus is described including a conventional shipping container 10, a partition 14 dividing the container into a fumigation chamber 16 and a control room 12, means arranged 24 to supply gas into the fumigation chamber 16, control means 26 located in the control room arranged to control the flow of gas into the fumigation chamber 16 and extraction means 36, 38, 40, 42, 44 arranged to remove gas from the fumigation chamber as controlled from the system control box 26.